

CLAIMS:

What is claimed is:

- 1 1. A method of synchronizing states of data between a plurality of devices over
2 an unreliable communication channel, the method comprising:
3 retrieving data from the devices;
4 updating centrally stored data, based on the data retrieved from the
5 devices, so as to automatically recover from a prior synchronization failure, if
6 any; and
7 updating the data states on the devices based on the updated centrally
8 stored data, including communicating with at least one of the devices over the
9 unreliable communication channel.
- 1 2. A method as recited in claim 1, wherein the unreliable communication
2 channel comprises a wireless network.
- 1 3. A method as recited in claim 2, wherein the wireless network is a wireless
2 telecommunications network.
- 1 4. A method as recited in claim 1, wherein said updating centrally stored data
2 comprises:
3 determining actual states of the data on the devices; and
4 updating centrally stored data indicating actions to be performed on the
5 devices and states of the data on the devices.

1 5. A method as recited in claim 4, wherein said updating the data states on the
2 devices comprises updating the data states on the devices based on the data
3 indicating actions to be performed on the devices and data indicating the actual
4 states of the data on the devices.

1 6. A method as recited in claim 1, wherein said updating centrally stored data
2 comprises:
3 updating a truth database representing a true state of the data; and
4 updating an action database indicating actions to be performed on the
5 devices during a next update.

1 7. A method as recited in claim 6, wherein said updating centrally stored data
2 further comprises:
3 creating an effective action database which accounts for any of the devices
4 which were offline during a previous synchronization; and
5 saving the truth database and the effective action database in an atomic
6 transaction;
7 wherein said updating the data on the devices comprises using the
8 effective action database to update the data on the devices.

1 8. A method of synchronizing states data between a plurality of devices, the
2 method comprising:
3 retrieving data from the devices;

4 automatically recovering from a prior synchronization failure, if any, by
5 updating centrally stored data; and
6 updating the data states on the devices, including communicating with at
7 least one of the devices over a wireless network.

1 9. A method as recited in claim 8, wherein the wireless network is a wireless
2 telecommunications network.

1 10. A method as recited in claim 8, wherein said automatically recovering from a
2 synchronization failure comprises:

3 determining actual states of the data on the devices; and
4 maintaining centrally stored data indicating actions to be performed on
5 the devices and the actual states of the data on the devices.

1 11. A method as recited in claim 10, wherein said updating the data states on the
2 devices comprises updating the data states on the devices based on the centrally
3 stored data.

1 12. A method as recited in claim 8, wherein said automatically recovering from a
2 prior synchronization failure by updating centrally stored data comprises:

3 updating a truth database representing a true state of the data; and
4 updating an action database indicating actions to be performed on the
5 devices during a next update.

1 13. A method as recited in claim 12, wherein said automatically recovering from
2 a prior synchronization failure by updating centrally stored data further
3 comprises:

4 creating an effective action database which accounts for any of the devices
5 which were offline during a previous synchronization; and

6 saving the truth database and the effective action database in an atomic
7 transaction;

8 wherein said updating the data on the devices comprises using the
9 effective action database to update the data on the devices.

1 14. A method of performing a synchronization process to synchronize states
2 data between a plurality of devices, the method comprising:

3 retrieving data from the devices;

4 maintaining data indicating actions to be performed on the devices and
5 data indicating the actual states of the data on the devices;

6 using a recovery algorithm to determine actual states of the data on the
7 devices;

8 updating the data indicating actions to be performed on the devices and
9 the data indicating the actual states of the data on the devices, based on results of
10 the recovery algorithm; and

11 updating the data states on the devices, including communicating with at
12 least one of the devices over a wireless network.

1 15. A method as recited in claim 14, wherein said updating the data states on the
2 devices comprises updating the data states on the devices based on the data
3 indicating actions to be performed on the devices and data indicating the actual
4 states of the data on the devices.

1 16. A method as recited in claim 14, wherein the wireless network is a wireless
2 telecommunications network.

1 17. A method of synchronizing states of data between a plurality of devices, the
2 method comprising:

3 maintaining a truth database representing a true state of the data;

4 maintaining an action database indicating actions to be performed on the
5 devices during a next update;

6 retrieving the data from the devices, including communicating with at
7 least one of the devices over the wireless network;

8 determining actual current states of individual elements of the data based
9 on the action database and the data retrieved from the devices;

10 updating the truth database and the action database based on a result of
11 said determining; and

12 updating the data on the devices, including communicating with at least
13 one of the devices over a wireless telecommunications network.

1 18. A method as recited in claim 17, wherein said determining comprises

2 determining actual current states of individual elements of the data so as to
3 automatically recover from a synchronization failure.

1 19. A method as recited in claim 17, wherein the data comprises contact data
2 representing a plurality of contacts.

1 20. A method as recited in claim 17, further comprising creating an effective
2 action database which accounts for any of the devices which were offline during
3 a previous synchronization; and

4 saving the truth database and the effective action database in an atomic
5 transaction;

6 wherein said updating the data on the devices comprises using the
7 effective action database to update the data on the devices.

1 21. A method synchronizing states of contact data between a plurality of
2 devices, the method comprising:

3 maintaining a truth database representing a true state of the contact data,
4 the contact data representing a plurality of contacts;

5 maintaining an action table for each of the devices, the action table
6 indicating actions to be performed on the corresponding device during a next
7 update;

8 retrieving contact data from the devices, including communicating with at
9 least one of the devices over a wireless telecommunications network;

determining actual current states of the contacts on the devices based on
the contact data retrieved from the devices and the action tables, so as to
automatically recover from a synchronization failure, if any;
updating the truth database and the action tables based on a result of said
determining;
creating an effective action table for at least one of the devices based on
the updated action table for the device and a previous version of the action table
for the device, to account for any of the devices which were offline during a
most-recent synchronization;
saving the truth database and the effective action table in an atomic
transaction; and
using the effective action table to update the states of the contact data on
the devices, including communicating with at least one of the devices over the
wireless telecommunications network.

22. An apparatus for synchronizing states of data between a plurality of devices
over an unreliable communication channel, the method comprising:
means for retrieving data from the devices;
means for automatically recovering from a prior synchronization failure, if
any; and
means for updating the data states on the devices based on the centrally
stored data, including communicating with at least one of the devices over the
unreliable communication channel.

1 23. An apparatus as recited in claim 22, wherein the unreliable communication
2 channel comprises a wireless network.

1 24. An apparatus as recited in claim 23, wherein the wireless network is a
2 wireless telecommunications network.

1 25. An apparatus as recited in claim 22, wherein said means for communicating
2 with at least one of the devices over the relatively unreliable communication
3 channel comprises means for communicating with said at least one of the devices
4 over a wireless communications network.

1 26. An apparatus as recited in claim 22, wherein said means for automatically
2 recovering from a synchronization failure comprises:
3 means for determining actual states of the data on the devices; and
4 means for updating centrally stored data indicating actions to be
5 performed on the devices and states of the data on the devices.

1 27. An apparatus as recited in claim 26, wherein said means for updating the
2 data states on the devices comprises means for updating the data states on the
3 devices based on the data indicating actions to be performed on the devices and
4 data indicating the actual states of the data on the devices.

1 28. An apparatus as recited in claim 27, wherein said means for automatically
2 recovering from a prior synchronization failure by updating centrally stored data

3 comprises:

4 means for updating a truth database representing a true state of the data;

5 and

6 means for updating an action database indicating actions to be performed
7 on the devices during a next update.

1 29. An apparatus as recited in claim 28, wherein said means for automatically
2 recovering from a prior synchronization failure comprises:

3 means for creating an effective action database which accounts for any of
4 the devices which were offline during a previous synchronization; and

5 means for saving the truth database and the effective action database in an
6 atomic transaction;

7 wherein said means for updating the data on the devices comprises means
8 for using the effective action database to update the data on the devices.

1 30. An apparatus to synchronize data states between a plurality of devices, the
2 apparatus comprising:

3 a database system to store

4 a truth database representing a true state of the data, and

5 an action database indicating actions to be performed on the
6 devices during a next update;

7 a recovery unit to determine actual current states of the data based on the
8 action database and data retrieved from the devices; and

9 a synchronization engine to update the truth database and the action
10 database, based on output of the recovery module, and to update data states on
11 the devices based on the action database, by communicating with at least one of
12 the devices over the wireless network.

1 31. An apparatus as recited in claim 30, wherein the wireless network is a
2 wireless telecommunications network.

1 32. An apparatus as recited in claim 30, wherein the synchronization engine
2 further is to update the truth database and the action database, based on output
3 of the recovery module, so as to automatically recover from a failure of a prior
4 synchronization.

1 33. A machine-readable program storage medium storing instructions which,
2 when executed in a processing system, cause the processing system to perform a
3 method of synchronizing states of data between a plurality of devices, at least
4 one of which is a mobile device operating on a wireless telecommunications
5 network, the method comprising:

6 maintaining a truth database representing a true state of the data;
7 maintaining an action database indicating actions to be performed on the
8 devices during a next update;
9 retrieving the data from the devices, including communicating with at
10 least one of the devices over the wireless telecommunications network;

11 determining actual current states of individual elements of the data based
12 on the action database and the data retrieved from the devices;
13 updating the truth database and the action database based on a result of
14 said determining; and
15 updating the data on the devices, including communicating with at least
16 one of the devices over the wireless telecommunications network.

1 34. A machine-readable program storage medium as recited in claim 33, wherein
2 said determining comprises determining actual current states of individual
3 elements of the data so as to automatically recover from a synchronization
4 failure.

1 35. A machine-readable program storage medium as recited in claim 33, wherein
2 the data comprises contact data representing a plurality of contacts.

1 36. A machine-readable program storage medium as recited in claim 33, wherein
2 the method further comprises creating an effective action database which
3 accounts for any of the devices which were offline during a previous
4 synchronization; and

5 saving the truth database and the effective action database in an atomic
6 transaction;

7 wherein said updating the data on the devices comprises using the
8 effective action database to update the data on the devices.

1 37. A processing system comprising:

2 a processor;

3 a data communication device coupled to the processor to communicate
4 data with a plurality of remote devices, at least one of which operates on a
5 wireless telecommunications network; and

6 a storage facility coupled to the processor and storing instructions for
7 execution by the processor to cause the processing system to perform a method
8 comprising:

9 maintaining a truth database representing a true state of data
10 maintained by the devices;

11 maintaining an action database indicating actions to be performed
12 on the devices during a next update;

13 retrieving the data from the devices, including communicating with
14 at least one of the devices over the wireless telecommunications network;

15 determining actual current states of individual elements of the data
16 based on the action database and the data retrieved from the devices;

17 updating the truth database and the action database based on a
18 result of determining the actual current states of individual elements of the data;

19 creating an effective action database which accounts for any of the
20 devices which were offline during a previous synchronization;

21 saving the truth database and the effective action database in an
22 atomic transaction; and

23 using the effective action database to update the data on the
24 devices, including communicating with at least one of the devices over the
25 wireless telecommunications network.

1 38. A processing system as recited in claim 37, wherein the data comprises
2 contact data representing a plurality of contacts.

1 39. A processing system as recited in claim 37, wherein said creating an effective
2 action database comprises creating the effective action database based on the
3 updated action table and a previous version of the action database to account for
4 any of the devices which were offline during a most-recent synchronization.